

List of Claims

1. (currently amended) A heat exchanger comprising:
a housing having an annular internal wall that defines a portion of a heat exchanging cavity;
a tube bundle positioned in said housing and including a plurality of tubes arranged in a hexagonal packing structure and a plurality of baffles;
said internal wall and said tube bundle defining a serpentine flow path that includes a plurality of flow direction changing windows;
said plurality of tubes including a perimeter set of tubes that define a bundle perimeter that is separated from said internal wall by a window distance at said windows, and separated by a gap distance away from said windows; and
said window distance is greater than said gap distance.

2. (currently amended) ~~The heat exchanger of claim 1 wherein~~ A heat exchanger comprising:
a housing having an annular internal wall that defines a portion of a heat exchanging cavity;
a tube bundle positioned in said housing and including a plurality of tubes and a plurality of baffles;
said internal wall and said tube bundle defining a serpentine flow path that includes a plurality of flow direction changing windows;
said plurality of tubes including a perimeter set of tubes that define a bundle perimeter that is separated from said internal wall by a window distance at said windows, and separated by a gap distance away from said windows;
said window distance is greater than said gap distance; and
said gap distance is uniform for a segment of said bundle perimeter corresponding to a plurality of adjacent tubes of said perimeter set of tubes.

3. (currently amended) ~~The heat exchanger of claim 1 wherein~~ A heat exchanger comprising:

a housing having an annular internal wall that defines a portion of a heat exchanging cavity;

a tube bundle positioned in said housing and including a plurality of tubes and a plurality of baffles;

said internal wall and said tube bundle defining a serpentine flow path that includes a plurality of flow direction changing windows;

said plurality of tubes including a perimeter set of tubes that define a bundle perimeter that is separated from said internal wall by a window distance at said windows, and separated by a gap distance away from said windows;

said window distance is greater than said gap distance; and

said window distance is uniform for a segment of said bundle perimeter corresponding to a plurality of adjacent tubes of said perimeter set of tubes

4. (original) The heat exchanger of claim 1 wherein said bundle perimeter is oblong

5. (original) The heat exchanger of claim 1 wherein said gap distance is less than a diameter of one of said tubes.

6. (cancelled)

7. (currently amended) ~~The heat exchanger of claim 1 wherein~~ A heat exchanger comprising:

a housing having an annular internal wall that defines a portion of a heat exchanging cavity;

a tube bundle positioned in said housing and including a plurality of tubes and a plurality of baffles;

said internal wall and said tube bundle defining a serpentine flow path that includes a plurality of flow direction changing windows;

_____ said plurality of tubes including a perimeter set of tubes that define a bundle perimeter that is separated from said internal wall by a window distance at said windows, and separated by a gap distance away from said windows;

_____ said window distance is greater than said gap distance; and

_____ said bundle perimeter has a hexagonal shape.

8. (cancelled)

9. (currently amended) ~~The heat exchanger of claim 1 wherein~~ A heat exchanger comprising:

_____ a housing having an annular internal wall that defines a portion of a heat exchanging cavity;

_____ a tube bundle positioned in said housing and including a plurality of tubes and a plurality of baffles;

_____ said internal wall and said tube bundle defining a serpentine flow path that includes a plurality of flow direction changing windows;

_____ said plurality of tubes including a perimeter set of tubes that define a bundle perimeter that is separated from said internal wall by a window distance at said windows, and separated by a gap distance away from said windows;

_____ said window distance is greater than said gap distance; and

_____ said housing is one-piece, homogenous and includes one of aluminum and iron; and

said tubes are identical lengths of copper tubing.

10. (currently amended) ~~The heat exchanger of claim 1 wherein~~ A heat exchanger comprising:

_____ a housing having an annular internal wall that defines a portion of a heat exchanging cavity;

_____ a tube bundle positioned in said housing and including a plurality of tubes and a plurality of baffles;

_____ said internal wall and said tube bundle defining a serpentine flow path that includes a plurality of flow direction changing windows;

_____ said plurality of tubes including a perimeter set of tubes that define a bundle perimeter that is separated from said internal wall by a window distance at said windows, and separated by a gap distance away from said windows;

_____ said window distance is greater than said gap distance; and

_____ said internal wall includes a pair of planar wall segments that are parallel to one another; and

said windows are partially defined by said planar wall segments.

11. (original) The heat exchanger of claim 10 wherein said bundle perimeter has a hexagonal shape that is also oblong.

12. (currently amended) ~~The heat exchanger of claim 1 wherein~~ A heat exchanger comprising:

_____ a housing having an annular internal wall that defines a portion of a heat exchanging cavity;

_____ a tube bundle positioned in said housing and including a plurality of tubes and a plurality of baffles;

_____ said internal wall and said tube bundle defining a serpentine flow path that includes a plurality of flow direction changing windows;

_____ said plurality of tubes including a perimeter set of tubes that define a bundle perimeter that is separated from said internal wall by a window distance at said windows, and separated by a gap distance away from said windows;

_____ said window distance is greater than said gap distance; and

_____ said windows have a window width that is greater than said cavity height.

13. (currently amended) ~~The heat exchanger of claim 1 wherein~~ A heat exchanger comprising:

_____ a housing having an annular internal wall that defines a portion of a heat exchanging cavity;

_____ a tube bundle positioned in said housing and including a plurality of tubes and a plurality of baffles;

_____ said internal wall and said tube bundle defining a serpentine flow path that includes a plurality of flow direction changing windows;

_____ said plurality of tubes including a perimeter set of tubes that define a bundle perimeter that is separated from said internal wall by a window distance at said windows, and separated by a gap distance away from said windows;

_____ said window distance is greater than said gap distance; and

_____ said tube bundle includes an odd number of tube rows sequentially arranged along a height dimension; and

one of said tube rows is longer than all other ones of said tube rows.

14. (original) An engine having an oil cooler according to the heat exchanger of claim 1.

15. (currently amended) A heat exchanger comprising:

a housing having an annular internal wall that defines a portion of a heat exchanging cavity;

a tube bundle positioned in said housing and including a plurality of tubes arranged in a hexagonal packing structure and a plurality of baffles, ~~and each of said tubes being adjacent to at least three other tubes;~~

said internal wall and said tube bundle defining a serpentine flow path that includes a plurality of flow direction changing windows; and

said plurality of tubes including a perimeter set of tubes that define a bundle perimeter that is separated from said internal wall by a window distance at said windows, and separated by a gap distance away from said windows.

16. (original) The heat exchanger of claim 15 wherein said bundle perimeter is oblong.

17. (original) The heat exchanger of claim 16 wherein said internal wall includes a pair of planar wall segments that are parallel with respect to one another; and said windows are partially defined by said pair of planar wall segments.

18. (original) The heat exchanger of claim 17 wherein said heat exchanging cavity has a cavity width and a cavity height that are uniform along a cavity length.

19. (original) The heat exchanger of claim 18 wherein said gap distance is uniform for a segment of said bundle perimeter corresponding to a plurality of adjacent tubes of said perimeter set of tubes; and

said window distance is uniform for a segment of said bundle perimeter corresponding to a different plurality of adjacent tubes of said perimeter set of tubes.

20. (original) An engine having an oil cooler according to the heat exchanger of claim 19; and

said window distance is greater than said gap distance.

21. (new) The heat exchanger of claim 1 wherein the internal wall associated with the gap distance has a non-planar irregular surface.

22. (new) The heat exchanger of claim 1 including a separation distance between baffles, a separation distance between adjacent tubes and a window opening size have a relationship corresponding to a flow area at any given point in the heat exchanger.